the opportunity to read the more extensive and scattered papers that deal with the subject.—J. M. C.

THE SECOND and concluding part of the second supplement (1896–1900) of the *Kew Index* has appeared.[4] A notice of the first part appeared in BOT. GAZETTE **39**:68. 1905. The second part includes the letters L–Z, and also six pages of corrections and additions.—J. M. C.

NOTES FOR STUDENTS.

THE PROBLEM OF HEREDITY.—THIS important contribution[5] is similar in plan to the famous *Cytologische Studien aus dem Bonner Institut* which played such an important part during the centrosome controversies. The present work deals with the problem of chromatin reduction and with theoretical considerations connected with this problem. STRASBURGER[6] writes on typic and allotypic[7] nuclear division, ALLEN on the behavior of the nuclear substance during synapsis in the pollen mother-cells of *Lilium canadense*, MIYAKE on the reduction division in the pollen mother-cells of certain monocotyledons, and OVERTON on the reduction division in the pollen mother-cells of certain dicotyledons.

The four writers agree that the nuclear network consists of both linin and chromatin, and all but ALLEN describe a reducing or qualitative division of the chromatin during the first mitosis in the pollen mother-cell.

STRASBURGER studied various pollen mother-cells and also the megaspore mother-cells, all of which are drawn from nuclei of the ovary walls and placenta of *Galtonia candicans* and *Funkia Sieboldiana*. His figures represent close series from the resting stage to telophase. Considerable variation in the number of chromosomes was found in both forms. The bearing of this fact upon the theory of the individuality of the chromosomes is discussed, and the conclusion is reached that the number of chromosomes is fixed by heredity, but not within such rigid limits as to exclude some variation in vegetative cells. The definite

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[4] Index Kewensis plantarum Phanerogamarum: supplementum secundum nomina et synonyma omnium generum et specierum ab initio anni MDCCCXCVI usque ad finem anni MDCCCC complectens. Ductu et consilio W. T. Thiselton-Dyer confecerunt herbarii horti regii botanici Kewensis curatores. Leucocoryne–Zygostates et emendanda addenda. Pp. 105–204. Oxford: Clarendon Press. 1905. 12*s*.

[5] STRASBURGER, E., ALLEN, C. E., MIYAKE, K., and OVERTON, J. B., Histologische Beiträge zur Vererbungsfrage. Jahrb. Wiss. Bot. **42**:1–153. *pls. 1–7*. 1905.

[6] STRASBURGER, E., Typische und allotypische Kernteilung. Jahrb. Wiss. Bot. **42**:1–70. *pl. 1*. 1905.

[7] By typic divisions are understood the ordinary vegetative or somatic divisions; the allotypic divisions are the two divisions usually called the heterotypic and homotypic divisions. The term allotypic is equivalent to the term maiotic as used by FARMER. STRASBURGER would restrict the term atypic to pathological mitosis.

number seems essential only in the gonotokonts,[8] when it insures the pairing of paternal and maternal chromosomes. The chromosomes of a nucleus probably differ among themselves, and it is almost certain that the two chromosomes of each pair pass to different nuclei. The heterotypic and homotypic mitoses differ in that the first distributes to the daughter nuclei the paired, univalent, and already longitudinally split paternal or maternal chromosomes, while the second separates the longitudinal halves of chromosomes whose longitudinal splitting was already prepared during the prophase of the first mitoses. The behavior of chromatin in fertilization and in parthenogenesis is discussed in detail. STRASBURGER'S paper closes with a reinvestigation of the peculiar hybrid, *Cystisus Adami*, showing that there is no cytological basis for the assumption that it is a graft hybrid.

ALLEN[9] describes, in greater detail than in his previous papers, the behavior of the nuclear material from the resting reticulum up to the spirem of the heterotypic division. Some of the principal features of this period are: (1) a collecting of the materials belonging to the somatic chromosome, (2) an approximation and pairing of two somatic (presumably paternal and maternal) groups of substances, (3) a stretching of the visible nuclear structures (except the nucleolus) into slender threads which come to lie side by side and finally fuse, (4) the disappearance of anastomoses and the formation of a continuous spirem, and (5) a uniseriate distribution of chromosomes in each thread, the opposition of the chromosomes of parallel threads, followed by the fusion of the threads and union of the chromosomes in pairs.

MIYAKE[10] studied the reduction division in the pollen mother-cells of Galtonia, Iris, Lilium, Allium, Funkia, and Tradescantia. In synapsis there is not a pairing of fully formed chromosomes, but of groups of chromatic substance. These groups are drawn out into a double thread, which may be regarded as approximated chains of chromosome pairs. The chromosomes, paired at this early stage, continue to grow as pairs until mature. In the heterotypic mitosis the two members of each pair are separated and pass to opposite poles. Consequently, this mitosis is a reduction or qualitative division. The second mitosis is a doubling (*Äquationsteilung*) division.

OVERTON[11] studied the reduction division most thoroughly in *Thalictrum purpurascens*, but for comparison used also *Helleborus foetidus*, *Podophyllum*

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[8] The term, *Gonotokonten*, proposed by LOTSY, applies to spore mother-cells of plants and to the primary spermatocytes and primary oocytes of animals.

[9] ALLEN, C. E., Das Verhalten der Kernsubstanzen während der Synapsis in den Pollenmutterzellen von *Lilium canadense*. Jahrb. Wiss. Bot. **42**:71–82. *pl. 2.* 1905.

[10] MIYAKE, K., Ueber Reduktionsteilung in den Pollenmutterzellen einiger Monokotylen. Jahrb. Wiss. Bot. **42**:83–120. *pls. 3–5.* 1905.

[11] OVERTON, J. B., Ueber Reduktionsteilung in den Pollenmutterzellen einiger Dikotylen. Jahrb. Wiss. Bot. **42**:121–153. *pls. 6–7.* 1905.

peltatum, *Calycanthus floridus* and *Campanula grandis*. In very young pollen mother-cells he finds masses of chromatin which he calls prochromosomes. The prochromosomes are in pairs and their number is the same as that found in somatic nuclei. The parental chromosomes maintain their identity during synapsis. The first division is a reduction division in which entire univalent chromosomes, which were united during synapsis, become separated. The second mitosis is a doubling division. It is probable that the two halves of the presynaptic chromosomes are of paternal and maternal origin, and that during synapsis there is a union of paternal and maternal elements.—C. J. CHAMBERLAIN.

THE INHERITANCE of coat characters in guinea-pigs and rabbits has been studied by CASTLE[12] during the last five years, and his first detailed report has appeared in the series of papers of the Station for Experimental Evolution. In breeding about 3,000 guinea-pigs and several hundred rabbits he finds that the following characters obey MENDEL'S laws, the first mentioned member of each pair of characters being dominant: pigmented coat *vs.* albino, rough coat *vs.* smooth, long coat *vs.* short. Albinism and long hair are conceived to be new characters and their recessiveness agrees, therefore, with the view that phylogenetically older characters dominate the newer; but the rough coat, which is dominant over smooth, is nowhere found among guinea-pigs in their native state and is likewise a new character. This shows, as has been done recently by CORRENS[13] also, that ancestral characters do not necessarily dominate the new characters in inheritance. The dominance of the rosetted or rough coat over the smooth may be considered as supporting CORRENS'S view that the morphologically higher dominates the lower, but this view is negatived in the dominance of short coat over long. It seems to be impossible at the present time to predict which of an uninvestigated pair of characters will be dominant.

The author draws a sharp distinction between recessive and latent characters, the latter being defined as "characters normally dominant, which have disappeared in recessive gametes beyond hope of recall, except under conditions of cross breeding which are in most cases not entirely clear." He expresses a doubt whether a recessive character may ever be latent, though there appear to be no *a priori* grounds for such a difference of behavior in the two kinds of characters.

In a case between certain white individuals and red, about half the offspring were black pigmented. The assumption that in these individuals two kinds of gametes were produced in nearly equal proportions, the one kind containing latent black, the other being entirely free from black, was proved by breeding tests of the non-black offspring, no black pigmented young resulting from these matings. This difference of behavior between the purebred race and the extracted recessives resembles BATESON'S experiences with sweet peas and stocks.[14]

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[12] CASTLE, W. E., Heredity of coat characters in guinea-pigs and rabbits. pp. 78. Washington: Carnegie Institution of Washington. 1905.

[13] See résumé in BOTANICAL GAZETTE **40**:235. 1905.

[14] See résumé in BOTANICAL GAZETTE **40**:313. 1905.

Several irregularities were noted, such as occasional imperfect dominance in combinations where one of the characters is usually fully dominant, but in these cases the blended condition in the first generation was followed by typical splitting in the second. Length of ears and lop ears of rabbits were found to blend in inheritance, the second and subsequent generations retaining the blended or intermediate condition.

The paper is illustrated with six plates of excellent halftone engravings, representing the various coat characters and their hybrid combinations. Ten of these engravings with a few others are reproduced in another paper[15] by the same author, in which his more important results are used to illustrate the recent advances in our knowledge of the laws of heredity and their practical applications in plant and animal breeding. This paper was read before the American Breeders' Association at its second meeting, at Champaign, Ill., February 1–3, 1905, and is also published without the plates in the Proceedings[16] of that organization.—G. H. SHULL.

THE SYMPOSIUM of six addresses on the mutation theory, delivered before the American Society of Naturalists at Philadelphia, December 28, 1904, has been published in full in *Science*. One of these addresses, which was published elsewhere, has already been noted in these columns.[17] CASTLE[18] discusses the subject from the standpoint of the animal breeding, illustrating with his results in guinea-pigs. He observed extra toes and long hair to arise as mutations and shows that long-haired and normal short-haired animals could coexist and interbreed freely without ever swamping the long-haired condition, as it behaves as a Mendelian recessive. Natural selection could then determine which if either of these forms should be eliminated. If inheritance is not sharply alternative the mutation would simply act to increase the fluctuating variability and could never become a racial character through natural selection.

In considering the relation of cytology to the mutation theory, CONKLIN[19] emphasizes the fact that all evolution must be the evolution of the germ-cells and is founded primarily upon cytological phenomena. The great morphological complexity of the germ-cells which recent studies have demonstrated, and the speaker's observations on the diffusion of chromatin from the nucleus to definite areas of the cytoplasm of the ascidian egg, are cited as favoring the hypothesis

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[15] CASTLE, W. E., Recent discoveries in heredity and their bearing on animal breeding. Pop. Sci. Monthly **66**: 193–208. 1905.

[16] Proc. Amer. Breeders' Assn. **1**: 120–126. 1905.

[17] MACDOUGAL, D. T., Discontinuous variation and the origin of species. Torreya **5**: 1–6. 1905; and Science N. S. **21**: 540–543. 1905.

[18] CASTLE, W. E., The mutation theory of organic evolution from the standpoint of animal breeding. Science N. S. **21**: 521–525. 1905.

[19] CONKLIN, E. G., The mutation theory from the standpoint of cytology. Science N. S. **21**: 525–529. 1905.

of "intracellular pangenesis." Modifications of the germinal organization are probably the immediate causes of evolution. Even a slight alteration in the unsegmented egg may result in a profound change in the adult as illustrated in the production of dextral and sinistral forms of mollusks by maturation taking place, now at the one pole, now at the other.

DWIGHT[20] concludes that evidences from human anatomy offer no support for the theory of evolution by minute changes, and that although they do not give any direct support to the mutation theory they are not in disaccord with it.

BAILEY[21] discusses the relation between taxonomy and evolution, pointing out some of the weak points in the present system of classification, particularly in that taxonomic systems are rigid and arbitrary, whereas the organic world is plastic and changing. He holds that the ideal taxonomy of the future must make no distinction between "natural" and "artificial" forms, and that the type of a species should be the real phylogenetic or biological type instead of the first specimen which chanced to be named. There can never be such a thing as a satisfactory "stable" nomenclature.

WHEELER[22] considers the mutation theory even more important in the explanation of the origin of new instincts, new functions and new habits of life, than for the origin of new morphological characters, especial mention being made of parasitic species and species with profound and sudden metamorphoses.—G. H. SHULL.

THE GERMINATION of *Coleochaete scutata* has been studied by ALLEN[23] who has paid particular attention to cytological features of the first and second divisions of the fertilized egg. Fertilization takes place in the summer. After resting during the winter, the fertilized egg segments into a number of cells, in each of which a zoospore is developed.

In the prophase of the first mitosis a condition is found which the author regards as a genuine synapsis, during which a fusion of somatic chromosomes occurs, as in his account of Lilium. The chromosomes formed from the spirem are bivalent, the line of separation corresponding to the earlier longitudinal splitting of the spirem. Occasionally the arrangement of chromatin granules suggests that the chromosomes may be quadrivalent. The number of chromosomes is probably thirty-two. No centrosomes or centrospheres could be distinguished. At the second division the chromosomes are longer and more slender than those of the first division. A cell plate is formed at each division. The two divisions correspond quite closely with the heterotypic and homotypic divisions

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[20] DWIGHT, THOMAS, Mutations. Science N. S. **21**:529–532. 1905.

[21] BAILEY, L. H., Systematic work and evolution. Science N. S. **21**:532–535. 1905.

[22] WHEELER, W. M., Ethology and the mutation theory. Science N. S. **21**: 535–540. 1905.

[23] ALLEN, C. E., Die Keimung der Zygote bei Coleochaete. Ber. Deutsch. Bot. Gesells. **23**:285–292. *pl. 13*. 1905.

in pollen mother-cells of angiosperms. It seems probable that a reduction of chromosomes is effected during these two divisions. If this is correct, there is in Coleochaete no generation with the double number of chromosomes, except the zygote itself. There is no generation which could be called a sporophyte. Each cell of the spore mass which has usually been regarded as the sporophyte has the reduced number of chromosomes like the vegetative cells of the thallus.

The statement that there is no generation which could be called a sporophyte, seems to the reviewer to be a serious mistake. Riccia has a sporophyte just as truly as has Sequoia, the extent of its development being unessential as far as the logical presence of a sporophyte is concerned. The sporophyte generation in lower plants as well as in higher begins with the fertilized egg. Whether the egg then divides once, twice, or a million times, or not at all, neither strengthens nor weakens its title to the term, sporophyte. It seems to us that there is an important difference between extreme reduction and complete elimination.—C. J. CHAMBERLAIN.

ITEMS OF TAXONOMIC INTEREST are as follows: R. VIGUIER (Bull. Soc. Bot. France IV. **5**:285–314. 1905), in presenting the Polyscias group of Araliaceae, has described two new genera—*Tieghemopanax*, with 26 species; and *Bonnierella* with one species.—J. M. GREENMAN (Proc. Amer. Acad. **41**:235–270. 1905) has published descriptions of new species of angiosperms from the southwestern United States, Mexico, and Central America, the new genera being *Mimophytum* (Boraginaceae) and *Lozanella* (Urticaceae), both from Mexico, and the new species from the southwestern United States belonging to Cassia, Cedronella, Salvia, and Erigeron.—B. L. ROBINSON (*idem* 271–278), among diagnoses and notes relating to American Eupatorieae, has described new species in Ageratella (which here receives its first formal and detailed characterization as a genus), Fleischmannia, Piptothrix, and Eupatorium (5).—W. A. MURRILL (Bull. Torr. Bot. Club **32**:353–371. 1905), in a synopsis of the brown pileate species of North American Polyporaceae, describes the following new genera: *Coriolopsis* (2), *Flaviporus* (2), *Cerrenella* (2), *Nigroporus*, *Fomitella*, *Amauroderma* (3), and *Porodaedalea*.—C. L. GRUBER (*idem* 389–392) has described 3 new species of Crataegus from Berks Co., Pa.—PH. VAN TIEGHEM (Ann. Sci. Nat. Bot. IX. **1**:247–320. 1905) has established a new family *Irvingiaceae* upon the genus Irvingia and three allied genera, which have been associated heretofore with the Simarubaceae.—W. J. TUTCHER (Jour. Linn. Soc. London **37**:58–70. 1905), among other new Chinese plants, has described a new genus (*Dunnia*) of Rubiaceae.—OTTO STAPF (*idem* 79–115), in his "Contributions to the flora of Liberia," has described the following new genera: *Atroxima* (Polygalaceae), *Urobotrya* (Olacaceae), *Androsiphonia* (Passifloraceae), and *Afrodaphna* (Lauraceae).—M. L. FERNALD (Rhodora **7**:146–150. 1905), in presenting the genus Arnica in northeast America, recognizes seven species, describing three as new.—J. M. C.

IN A PAPER read before the Royal Dublin Society, DIXON[24] answers recent

[24] DIXON, H. H., The cohesion theory of the ascent of sap. Notes Bot. Soc. Trinity Coll. Dublin **1**:203–216. 1905.

criticisms made on the cohesion theory of the ascent of sap by STEINBRINCK and by COPELAND.

STEINBRINCK established the fact that the walls of the conducting tracts are permeable to air and regards this as incompatible with the cohesion theory, since air diffusing through the tracheal walls would tend to break the continuity of the water columns within them, by the formation of free bubbles. In reply to this, DIXON states that the air in solution does not cause the rupture of a water column under tension; that the permeability of the walls does not necessitate the formation of free bubbles in the conducting tracts; and that even if bubbles are formed the current is merely deflected from that portion of the channel.

In regard to the results obtained by COPELAND, that the ascent of water in his "tree" was due not to a pull transmitted downward by the cohesion of water, but to some force which is measured by the difference in pressure as indicated by the manometers at the bottom and 8.4^{m} from the bottom of the "tree," DIXON shows that according to COPELAND a column of water 8.4^{m} high, equivalent to 617^{mm} mercury, is supported by a pressure of 122^{mm} of mercury, which is impossible. DIXON further believes, and brings experimental evidence to support his belief, that the pressure conditions indicated by COPELAND's manometers are local and have nothing to do with the true pressure conditions in the tube as a whole. The arguments on this point are twofold. First, it is shown that plaster of Paris long continues to absorb water and this may cause the rise of mercury in the manometers; second, the rate of transmission of water through tubes of plaster of Paris as used by COPELAND is so slow, that equalization of pressure conditions by the passage of water through a distance of 8.4^{m} is impossible.—H. HASSELBRING.

DIXON[25] describes an interesting transpiration model which will prove useful for illustration. The apparatus consists of a thistle tube closed by two parchment membranes so arranged that a lenticular cell is formed between them. Gelatin tannate is precipitated in the membranes, and the cell is filled with dry sugar. When the tube is filled with water the parchment cell becoming turgid represents the system of turgid cells which in living plants, intervenes between the water-conducting channels and the outer air. This model will act until a leak is formed in the membrane, or until the diffusion of sugar into the tube makes the liquid below isotonic with that of the cell. The actual passage of water can be rendered visible by connecting the lower end of the tube with a capillary tube running across the stage of a microscope and dipping into a beaker of water in which minute solid particles are held in suspension. It is found that the water will rise although under tension, and that even then the cell will remain turgid, owing to the fact that although the water in the cell may be in a state of tension, the dissolved substances exert a pressure. That this condition can exist in the cells of plants is shown by the following interesting experiment. A small strip

[25] DIXON, H. H., A transpiration model. Notes Bot. Soc. Trinity Coll. Dublin 1:217–224. *fig.* 1. 1905.

of tissue taken from some suitable plant is placed in the long closed arm of a J-tube. The tube is filled with water and the atmospheric pressure is removed from the short arm by means of an air-pump. The strip of tissue, in the upper part of the column of water held in tension by the weight of the lower parts, remains curved showing an osmotic pressure existing in the cells in spite of this tension.—H. HASSELBRING.

CAMPBELL[26] has continued his studies of the Araceae by investigating *Anthurium violaceum leucocarpum* and *Nephthytis liberica*. The account of Anthurium is quite like that of the usual angiosperm. The archesporium in the ovule is a single hypodermal cell, which divides periclinally. The primary sporogenous cell passes directly into the megaspore without division; and in the development of the gametophyte to the fertilization stage there is nothing worthy of remark. In the formation of endosperm there is no free nuclear division, a wall appearing with the first division, which occurs at the antipodal end of the sac, the formation of endosperm thus proceeding from the antipodal toward the micropylar end of the sac. The embryo is at first an almost globular mass of cells, with a "rudimentary" suspensor. Nephthytis proved to be quite variable in the development of the embryo sac. The archesporial cells are variable in number, and generally more than one embryo sac begins to develop. In no case did the mature embryo sac show the usual angiospermous condition, and so great was the variation that no condition could be selected as the prevailing one in the species. Among the most striking forms of mature sacs are the following: two nuclei, one at each end; a complete egg apparatus and a single antipodal nucleus; three antipodal nuclei and a single micropylar nucleus; twelve or thirteen nuclei, the three uppermost fusing; various forms of chambered sacs; fusion of contiguous sacs. The general conclusion is reached that the Araceae are relatively primitive monocotyledons.—J. M. C.

VON SCHRENK[27] has given an account of intumescences formed on leaves of cauliflowers as a result of chemical stimulation. The plants had been sprayed with copper sprays; several days after application the wart-like growths were observed on the leaves. By an experimental analysis of the conditions causing the intumescences the author finds that they are readily produced by sprays of ammonium copper carbonate and other copper salts, and in some cases with ammonia and ammonium carbonate. Soil and atmospheric conditions, including heat and water supply, had nothing to do with their formation.

It is clear that the peculiar outgrowths of leaves known as intumescences are produced by various factors in different plants. Usually they have been attributed to excessive water in the tissues due to moist atmosphere, coupled with reduced photosynthesis. SORAUER, KÜSTER, and HABERLANDT have found them in

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[26] CAMPBELL, D. H., Studies on the Araceae. III. Annals of Botany **19**:329–349. *pls. 14–17*. 1905.

[27] VON SCHRENK, H., Intumescence formed as a result of chemical stimulation. Rept. Mo. Bot. Garden **16**:125–148. *pls. 25–31*. 1905.

certain cases due to the action of different poisons, and VON SCHRENK adds another clearly defined case due to action of specific chemical stimuli. In this connection it is interesting to note that almost simultaneously with VON SCHRENK, STEINER[28] has described intumescences on *Ruellia formosa* and *Aphilandra Porteana* which were produced regularly when the plants were transferred to an atmosphere of relatively greater humidity, while all attempts to produce them on the former plant by means of solutions, including copper sulfate failed. Aphilandra was apparently not subjected to this treatment.—H. HASSELBRING.

THE MICROSPORES of *Araucaria Bidwillii* are described in a preliminary paper by LOPRIORE.[29] The intine and exine are clearly differentiated, the intine being about twice as thick as the exine. The numerous large starch grains make it rather difficult to get a clear view of the internal structures. The spores germinate best in darkness in a 12 per cent. sugar solution. The pollen tubes reach their greatest length—about ten to twenty times the diameter of the pollen grain—in eight to ten days.

At the first division of the pollen mother-cells the number of chromosomes is twelve. As the spore germinates, two lens-shaped cells are cut off from the main body of the spore. These are not evanescent, but divide and give rise to a mass of about fifteen cells. The walls of these cells soon disappear, leaving the nuclei free in the general cytoplasm of the spore. Further nuclear division then takes place until the spore contains 20–44 nuclei, 36 being the most frequent number. There are no divisions after the pollen tube begins to develop. Two nuclei in the end of the tube, somewhat larger than the rest, are regarded as vegetative nuclei, while the others are regarded as equivalent to spermatozoids. Judging from LOPRIORE'S figures of the germination of the spore, the reviewer ventures to hazard the guess that the two larger nuclei are the male nuclei, while the rest of the numerous nuclei result from an unusual development of the prothallial region.—C. J. CHAMBERLAIN.

HENRY N. RIDLEY,[30] director of the Botanic Gardens at Singapore, has recorded some of his observations in the tropics on the dispersal of seeds by wind. He uses three categories: (1) winged fruits and seeds; (2) plumed fruits and seeds and (3) "powder-seed," by which he means such fine and dust-like bodies as the seeds of orchids and the spores of ferns. The nature of the observations may be illustrated from the account of *Shorea leprosula* (Dipterocarpaceae). The greatest distance the winged fruit of this species was observed to travel was about "100 yards," which is much more than the usual distance. The estimate is made that under the most favorable circumstances the species can spread only "300

[28] STEINER, R. S., Ber. Deutsch. Bot. Gesells. **23**:105. 1905.

[29] LOPRIORE, G., Ueber die Vielkörnigkeit der Pollenkörner von *Araucaria Bidwillii* Hook. Vorläufige Mitteilung. Ber. Deutsch. Bot. Gesells. **23**:335–346. *pl. 15*. 1905.

[30] RIDLEY, HENRY N., On the dispersal of seeds by wind. Annals of Botany **19**:351–363. 1905.

yards in 100 years," or it "would take 58,666 years to migrate 100 miles." The estimate is further made that a species of Dipterocarpus which ranges from the Malay Peninsula to the Philippines could not cover that distance, if there was land connection, in less than "one and a half million years." After the citation of numerous cases in each category, the general conclusion is reached that the winged seed or fruit is the slowest method of dispersal and is unable to cross any large stretch of sea; that the plumed seed or fruit, while adapted for quick dispersal over an open country. "is liable to be stopped in its migrations by dense forests;" and that "powder-seed" is adapted to the most rapid and distant dispersal.—J. M. C.

WORSDELL[31] has begun the publication of a series of papers entitled "The principles of morphology." The first one deals with the alternation of generations, and with the origin of the leafy sporophyte under which the theory of antithetic origin is approved and the opposing testimony of apogamy and apospory discredited; the conclusion being reached that "the three morphological categories of organs, viz., the leaf, stem, and root, which have persisted and remained distinct each from the other ever since the antiphytic generation attained any development, find their natural origin, therefore, in the capsule, seta, and foot or sucker respectively of the primitive bryophytic sporogonium."

The second paper[32] discusses the evolution of the sporangium. The conclusions are that the sporogonium of the primitive bryophyte is at once the homologue (1) of every type of foliar organ, (2) of every type of sporangiophore, (3) of every type of sporangium, (4) of the entire sporophyte. This is what he calls the doctrine of "variously graded" homologies. A concluding sentence is as follows: "The deductions from this idea are apparently, but only apparently, absurd; thus the sporogonium of a bryophyte must, for instance, be rigidly homologous both with an oak tree and with every single nucellus contained by every ovule of that oak tree." Appearances are not always so deceptive as the proverb would have us believe.—J. M. C.

HARPER continues to publish interesting ecological and floristic papers dealing chiefly with the flora of Georgia. One paper[33] gives an account of his explorations in 1903 in the coastal plain. A second paper[34] on Taxodium makes it pretty evident that *T. imbricarium* and *T. distichum* are specifically distinct, and that they have well defined and different characters and habitats. In noting the earlier paper, the reviewer was inclined to regard *T. imbricarium* as an ecological variety. *Pinus palustris*[35] was found at several stations at altitudes of

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[31] WORDSELL, W. C., The principles of morphology. I. New Phytol. **4**:124–133. 1905.

[32] ———, The principles of morphology. II. *Ibid.* **4**:163–170. 1905.

[33] HARPER, R. M., Phytogeographical explorations in the coastal plain of Georgia in 1903. Bull. Torr. Bot. Club **32**:141–171. 1905.

[34] ———, Further observations on Taxodium. *Ibid.* **32**:105–115. 1905.

[35] ———, Some noteworthy stations for *Pinus palustris*. Torreya **5**:55–60. 1905.

1,000 to 1,500 feet in northern Georgia. A fourth paper[36] gives a list of the ferns of Georgia, with full notes, and an introduction describing the geological and other features of the state. A paper[37] on the coastal plain plants of New England gives an annotated list of plants common to Georgia and other southern states and New England. Most of the plants belong to what may be called a sandy swamp flora, and many of them are found in northern Indiana near the shore of Lake Michigan.—H. C. COWLES.

ONE OF THE LATEST PUBLICATIONS of the Royal Botanical Garden at Berlin is a guide to the "biological" collections there installed. The beginnings of this phase of the Garden activities dates back to 1890, when Dr. ENGLER[38] assumed the directorship. In the cramped space of the old garden neither the "biological" nor phytogeographical display was such as to satisfy the ambitious director. In the new garden there is sufficient space to make an adequate display possible. The guidebook is arranged systematically by topics, corresponding to the arrangement of the Garden, and interesting notes are incorporated under nearly all of the headings. Among the topics illustrated are leaf position, leaf and stem adaptations in relation to photosynthesis, adaptations that protect against excessive transpiration, plants that utilize organic substances for food, stem types, pollination adaptations, movement phenomena, adaptation for seed dispersal. Such a plan is most admirable, and should be adopted as far as possible in many places.—H. C. COWLES.

THE BOTANICAL SURVEY of Scotland, so auspiciously begun by ROBERT SMITH, has been taken up by his brother, WILLIAM SMITH.[39] In the two districts here under review, the notes were gathered largely by the deceased senior author, and have been appreciatively brought together by the junior author after recent visits to Scotland. The general plan of the Forfar and Fife maps is that of the Edinburgh and Perthaline maps, as would be expected. The maps are accompanied by a text giving a full account of the various formations, in which the regions of cultivation are included as in the earlier studies. The woods are mainly oak, birch, and coniferous. In addition there are moors, heaths, grasslands, alpine, and maritime districts within the district under survey. At the close is a very interesting summary, embracing within brief compass the chief results of the British vegetation surveys to date, arranged according to GRAEBNER'S scheme of classification.—H. C. COWLES.

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[36] ———, The fern flora of Georgia. Fern Bulletin **13**:1–17. 1905.

[37] ———, Coastal plain plants in New England. Rhodora **7**:69–80. 1905.

[38] ENGLER, A., Führer durch die biologisch-morphologischen Abteilungen des Königl. botanischen Gartens zu Dahlem. Notizblatt Königl. Bot. Gartens, Appendix XVI. pp. 66. 1905.

[39] SMITH, ROBERT and WILLIAM G., Botanical Survey of Scotland. III and IV. Forfar and Fife. Scotland Geog. Mag. **20**:617–628. 1904. *Ibid.* **21**:1–20; 57–83; 117–126. 1905.

CLEMENTS[40] has given a short account of formation and succession herbaria. The idea of herbaria based on habitats in addition to those based on taxonomic characters seems to have been suggested by DRUDE, and has now been followed out in several places. No one has worked out the idea more systematically than has CLEMENTS in the Colorado mountains, and he distributed herbaria from there in 1901. Succession herbaria illustrate the dynamics of plant formations, and are the most desirable of ecological herbaria, but the most difficult to prepare. In his Colorado work the cryptogams, apart from the ferns, have been incorporated into a separate herbarium. The paper closes with an illustrated list of Colorado plants arranged by formations; in each formation there appears first the facies, followed by the principal and secondary species of the spring, summer, and autumn aspects.—H. C. COWLES.

KÜSTER[41] takes issue with SENN, who in a recent preliminary report has concluded that the position of chloroplasts in darkness is to be accounted for by an uneven distribution of the substance chemotactically potent upon them. The author's experiments with Dictyota and Padina especially, show that under the influence of hypertonic solutions the chloroplasts arrange themselves along the side walls (*Profilstellung*), while hypotonic solutions cause them to seek the upper and lower walls (*Flächenstellung*). The change in turgor pressure of the cell is thus the direct cause of orientation movements of the chromatophores and this change may be induced by light, or by hyper- or hypotonic solutions independently of light.—RAYMOND H. POND.

MISS LATHAM,[42] Barnard College, in investigating the response of fungi to the vapor of chloroform, has reached the following conclusions: (1) when present in small quantities chloroform vapor acts as a characteristic stimulant to the growth of *Sterigmatocystis nigra* and *Penicillium glaucum;* (2) larger quantities are inimical or fatal; (3) increased growth is attended by relatively less acid formation and less sugar consumption, indicating greater economy in metabolism; (4) the time of greatest sensitiveness is at the germination of the spores; (5) chloroform acts as a stimulant purely, since it cannot be a source of carbon; (6) the effect of a given amount of the anaesthetic is greater as the temperature rises.—J. M. C.

DARBISHIRE[43] has undertaken a study of Mamillaria, especially with a view to interpreting the significance of the plant form and the spines. Observations

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[40] CLEMENTS, F. E., Formation and succession herbaria. University of Nebraska Studies **4**: no. 4. pp. 27. 1904.

[41] KÜSTER, E., Ueber den Einfluss von Lösungen verschiedener Konzentration auf die Orientierungsbewegungen der Chromatophoren. Ber. Deutsch. Bot. Gesells. **23**:254–256. 1905.

[42] LATHAM, MARION ELIZABETH, Stimulation of Sterigmatocystis by chloroform. Bull. Torr. Bot. Club **32**:337–351. 1905.

[43] DARBISHIRE, O. V., Observations on *Mamillaria elongata.* Annals of Bot. **18**:375–416. 1904.

were made on the morphology, stem anatomy, root, and tubercle. The author holds that plant characters are to be regarded as useful now as formerly, and that, especially in adverse conditions, useless characters are unlikely to occur. Thus the structures of a desert plant like a cactus are presumably responses to desert conditions. DARBISHIRE does not favor the protective theory of spines, but he holds that these spines serve the purpose of light screens, whence he calls them paraheliodes.—H. C. COWLES.

PAMMEL[44] has recently published the results of his study in Iowa of the apple rust and of the fungi causing this well known disease. The account of each of five species of Gymnosporangium includes the important literature, its structure, and its polymorphism. Many original inoculation experiments are reported regarding the connection of the above species with the aecidial stage formerly included in the form genus Roestelia. As treatment the removal of the cedar trees is recommended wherever possible. Less favorable results from spraying apple trees were obtained than were reported by Emerson.[45]—E. MEAD WILCOX.

THERE IS BEGINNING to appear[46] in the *New Phytologist* a series of papers on the vegetation of various countries, the aim of which is less the presentation of the results of research than the awakening of further interest in the study of vegetation by making use of vivid personal sketches. The first papers deal with the shore vegetation of Ceylon, and there is a good account given of the typical tropical sand strand and of the mangrove and nipa formations. There are many cuts illustrating characteristic plant forms, and the description of the plant forms and formations is admirable.—H. C. COWLES.

TSCHERNIAJEW[47] finds that temperature affects the intensity of the aerobic respiration of wounded plants (onion bulbs), but not the anaerobic. This was ascertained by determining the rate of exhalation of carbon dioxid at elevated (30°–45°) and at ordinary temperatures (16°–19°). A higher temperature increases the intensity of aerobic respiration—the maximum, after wounding, appearing sooner than at ordinary temperature. Intramolecular respiration, however, at both ordinary and elevated temperatures, decreases in intensity after wounding.—RAYMOND H. POND.

COLLINS[48] has written a short account of an interesting Rhode Island bog,

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[44] PAMMEL, L. H., The cedar apple fungi and apple rust in Iowa. Bull. Iowa Exp. Stat. 84:1–36. *figs. 1–11.* 1905.

[45] EMERSON, R. A., Apple scab and cedar rust. Bull. Neb. Exp. Stat. 88:1–21. 1905. *figs. 1–9.* BOT. GAZETTE **40**:149. 1905.

[46] TANSLEY, A. G., and FRITSCH, F. E., Sketches of vegetation at home and abroad. I. The flora of the Ceylon littoral. New Phytol. **4**:1–17; 27–55. 1905.

[47] TSCHERNIAJEW, E., Ueber den Einfluss der Temperature auf die normale und die intramoleculare Atmung der verletzten Pflanzen. Ber. Deutsch. Bot. Gesells. 23:207–211. 1905.

[48] COLLINS, J. F., Some interesting Rhode Island bogs. Rhodora **6**:149–150. 1904.

in which four species hitherto unrecorded for the state were discovered (*Andromeda polifolia, Kalmia glauca, Eriophorum vaginatum, Arceuthobium pusillum*). The black spruce is more abundant than elsewhere in the state. Obviously this is a relict vegetation, and it is interesting to know that ice remains in this bog until late in May. The Andromeda was in full bloom, while the stems were yet imbedded in thick ice, a condition surely reminding one of the far north. —H. C. COWLES.

AN INSTRUCTIVE ECOLOGICAL STUDY of the giant cactus has been made by Mrs. SPALDING.[49] It is found that changes in bulk due to varying amounts of stored water are accompanied by circumferential stem changes accomplished by a bellows-like action of the ribs, which draw closer together as the circumference decreases, and move farther apart as it increases. Variations in circumference are least pronounced at the base and top; and differences are shown between the north and south sides. These changes in no way impair the mechanical system.—H. C. COWLES.

BLANKINSHIP[50] has published an historical account of botanical work in Montana. The frontispiece is an elegant colored plate of *Lewisia rediviva*. The accounts of collecting expeditions are arranged chronologically, and the bibliography of titles dealing with the state flora, arranged alphabetically, will be very helpful to students of the vegetation of that region. BLANKINSHIP[51] has also published a supplement to RYDBERG'S *Montana flora*, and in association with H. F. HENSHALL[52] he has prepared a list of the common names of Montana plants.—H. C. COWLES.

BULLER[53] has obtained some interesting data from the study of a single-gilled fungus whose saprophytism destroys paving blocks. When grown in light or in darkness papillae protrude which in the former case develop pilei but in the latter do not. The papillae remain rectipetal and indifferent to geotropic stimuli until exposed to light, when they become negatively geotropic and positively heliotropic. The latter sensitiveness is lost, however, during the formation of the pileus, which is dependent upon sufficient illumination.—RAYMOND H. POND.

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[49] SPALDING, EFFIE S., Mechanical adjustment of the suaharo (*Cereus giganteus*) to varying quantities of stored water. Bull. Torr. Bot. Club **32**:57–68. 1905.

[50] BLANKINSHIP, J. W., A century of botanical exploration in Montana, 1805–1905; collectors, herbaria, and bibliography. Mont. Agric. Coll. Sci. Studies **1**:3–31. 1905.

[51] ———, Supplement to the flora of Montana: additions and corrections. *Ibid.* **1**:33–109. 1905.

[52] BLANKINSHIP, J. W., and HENSHALL, H. F., Common names of Montana plants. *Ibid.* **1**:113–139. 1905.

[53] BULLER, A. H., R. The reactions of the fruit-bodies of *Lentinus lepideus* Fr. to external stimuli. Annals of Bot. **19**:427–436. *figs. 30.* 1905.

BOLLETER[54] has prepared an extended morphological and physiological monograph on *Fegatella conica* (L.) Corda. The subject is treated under the headings, general considerations, structure of the thallus, structure and development of the sexual shoots (including development of archegonia, antheridia and fertilization), development of the sporogonium and spores, germination of spores, development of the thallus, and asexual reproduction. It is a very complete study of the life-history and will be useful for reference.—C. J. CHAMBERLAIN.

LEAVITT,[55] in an interesting paper dealing with monstrosities in Drosera, Gentiana, and Saxifraga, uses the term "morphic translocation" in speaking of characters of one organ which appear suddenly on another organ, but without atavistic significance. The gentian spoken of had a petaloid fringe on the carpel, and the Drosera had glandular tentacles on perianth and carpels. The possible significance of such translocations, as well as the broader topic of the use of teratological data, is discussed rather fully.—H. C. COWLES.

OLSSON-SEFFER[56] tells of the plans of the Danish ecologist, M. P. PORSILD, for the establishment of a permanent laboratory in Greenland. The realization of these plans, thorough and yet modest from the standpoint of expenditure, would be of untold value to science, and it is to be hoped that the Danish government will grant PORSILD's request. This seems likely, in view of the liberality of Denmark to previous botanical explorers in Greenland.—H. C. COWLES.

WHILE LIGHT SEEMS to have little or no influence on the germination of most seeds, it favors the germination of some, and in the case of a very few (as Viscum, *Drosera capensis*), light is necessary for germination. Only in the case of *Acanthostachys strobilacea* had light been found to hinder germination. Now REMER[57] adds another plant, *Phacelia tanacetifolia*, to Acanthostachys. The ecological significance of such aberrants is unknown.—H. C. COWLES.

W. H. LAWRENCE[58] has published a short popular account of the Erysiphaceae, together with keys and descriptions of the genera and species found in the state of Washington. Notes are also presented upon six diseases of cultivated plants in Washington due to species of this well-known family. Spraying with Bordeaux mixture, cupram, or flowers of sulfur is recommended as the best means of controlling these mildews.—E. MEAD WILCOX.

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[54] BOLLETER, E., *Fegatella conica* (L.) Corda, Eine morphologisch-physiologisch Monographie. Beih. Bot. Centralbl. **18**:327–408. *pls. 12–13.* 1905.

[55] LEAVITT, R. G., On translocation of characters in plants. Rhodora **7**:1–17. 1905.

[56] OLSSON-SEFFER, P., A biological station in Greenland. Science **21**:189–191. 1905.

[57] REMER, W., Der Einfluss des Lichtes auf die Keimung bei *Phacelia tanacetifolia* Benth. Ber. Deutsch. Bot. Gesells. **22**:328–339. 1904.

[58] LAWRENCE, W. H., The powdery mildews of Washington. Bull. Wash. Exp. Stat. 70:1–16. *figs. 22.* 1905.

COCKAYNE[59] has found that *Discaria Toumatou*, a New Zealand xerophytic shrub that normally has long pungent spines, fails to develop these spines in moist chamber cultures. It is believed that the juvenile leafy shoots instead of spines would continue indefinitely in such conditions. He regards these facts as highly favorable to the xerophytic rather than the protective theory of thorns.—H. C. COWLES.

HARSHBERGER[60] proposes that the term zone in plant geography be restricted to broad belts determined by latitude, conforming to the law of priority as well as dominant usage. Mountain zones he would term belts; concentric pond zones, circumareas; submerged shore zones, shelves; strand, river, or prairie edge, strips; island zones, girdles; and vertical forest zones, layers.—H. C. COWLES.

HARSHBERGER has been making further floristic studies on the North American flora. One paper[61] deals with the comparative age of the various elements in eastern North America, and there is a chart that shows the supposed relative time of appearance of these elements from the Miocene until now. A second paper[62] deals briefly with centers of dispersal.—H. C. COWLES.

SWELLENGREBEL[63] finds something to attract him in the dunes of the Netherlands in spite of H. BLINK'S assertion that they have no true dune plants, and that if present they would be of no interest! The plant societies noted are those of the sea dunes, the gray dunes, and the dune hollows. Detailed notes are given concerning the source of the dune flora.—H. C. COWLES.

IN A LECTURE before a convention of practical farmers at Breslau, January, 1905, TSCHERMAK[64] gave a clear exposition of the recently discovered laws of inheritance and their significance for practical agriculture. He also included a brief discussion of variation and mutation.—G. H. SHULL.

A GOOD ACCOUNT[65] of the Desert Botanical Laboratory and of the more striking vegetation in its vicinity has been published by Professor LLOYD.—H. C. COWLES.

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[59] COCKAYNE, L., On the significance of spines in *Discaria Toumatou* Raoul (Rhamnaceae). New Phytol. **4**:79–85. 1905.

[60] HARSHBERGER, J. W., Suggestions toward a phytogeographic nomenclature. Science N. S. **21**:789–790. 1905.

[61] HARSHBERGER, J. W., The comparative age of the different floristic elements of eastern North America. Proc. Acad. Nat. Sci. Phil. **1904**:601–615.

[62] ———, Original centers concerned in North American plant dispersal. *Ibid.* **1905**:2.

[63] SWELLENGREBEL, N., Ueber niederländische Dünenpflanzen. Beih. Bot. Centralbl. **18**[2]:181–198. 1905.

[64] TSCHERMAK, E., Die neuentdeckten Vererbungsgesetze und ihre praktische Anwendung für die rationelle Pflanzenzüchtung. Reprint from Wiener Landw. Zeitg. nos. 17, 18, 19. pp. 31. 1905.

[65] LLOYD, F. E., A botanical laboratory in the desert. Pop. Sci. Monthly **66**: 329–342. 1905.